XXXIV.—*On new Species of* Hydractiniidæ, *Recent and Fossil, and on the Identity in Structure of* Millepora alcicornis *with* Stromatopora. By H. J. Carter, F.R.S. &c.

[Plate XVII.]

In the 'Annals' for 1873 (vol. xi. p. 10) I have inserted a description of a branched chitinous polypary, to which the late Dr. J. E. Gray had given the name of *Dehitella atrorubens*, under the idea that it was a sponge, but which subsequently proved to be a species of *Hydractinia*; and I have now to present the following description of a chitinous polypary like that of *Hydractinia echinata*, but with short branches here and there similar in form and colour to those of *Dehitella atrorubens*, which, on the contrary, grows into a bush-like polypary from a single, smooth, compressed, root-like stem.

Hydractinia arborescens, n. sp. (Pl. XVII. figs. 1–4.)

Polypary chitinous. Laminiform, surmounted by spines and branches indiscriminately scattered over the surface. Colour dark amber-brown (Pl. XVII. fig. 1). Surface following the form of the object over which the polypary may be growing (in this instance a turreted shell like *Phos senticosus*, family Buccinidæ); uniformly even, except where interrupted by the presence of spines and branches; presenting a granulated reticulation of short, broken, raised, serrulated ridges more or less surrounding minute holes once occupied by the polypites and other soft parts of the cœnosarc (figs. 2, *b*, *c*, and 3, *a*, *b*); traversed throughout by a venation of anastomosing grooves whose depth and distinctness is in proportion to their size, the largest being 1-180th inch in diameter (fig. 2, *a*, and fig. 4). Holes of the polypites, which are very numerous and equally present along the course of the vein-like grooves, as in the interstices of the granulated reticulation, may be best seen where the cœnosarc has been well washed out, varying in size, according to their office, from 2 to 3-1800ths inch in diameter (fig. 2). Spines conical, variable in size and length, scattered more or less partially over the surface so as to leave here and there plane intervals of greater or less extent; often growing into erect branches variable also in length and thickness (fig. 1, *a a a*), the largest, which in this instance forms one of a group at the anterior extremity of the shell, being 1-12th inch in diameter at the base (fig. 1, *b*), and the remaining longest portion of the rest (for they have all been broken off more or less close to their origin in the laminiform part of the polypary) 1-3rd

of an inch. In all there were thirty branches or processes, of which those at the extremities of the shell respectively were the largest and most subdivided. Spines and branches presenting the same kind of surface as that of the rest of the polypary, with the exception that the serrulated ridges of the granulated reticulation being longer, thus give rise to oblong or more or less elongated interstices; those on the spines forming a series of grano-serrulated ridges, diminishing in number upwards, until the last three or four, uniting into a point at the summit as in *Hydractinia echinata*, thus close the cancellated structure of which the spine is otherwise composed. Branches more or less divided and covered with small spines, which terminate the free ends in an alternate manner like those of *Sertularia*. Internal structure cancellous throughout and in direct continuity with the surface through the holes of the polypites, so that the cœnosarc thus forms a continuous mass, in which the chitinous, clathrous polypary, having been developed, becomes its skeleton or organ of support, sometimes extending into the calcareous material of the shell itself, and transforming the whole lip, as in the present instance, into polypary (fig. 1, *d*). Size depending upon that of the object over which the *Hydractinia* may be growing; in the present instance the shell covered by it is $2\frac{1}{4}$ inches by $\frac{3}{4}$ inch broad in its greatest diameters.

Hab. Marine, growing over hard objects; in the present instance completely covering a shell like *Phos senticosus* or *Fusus sulcatus*.

Loc. ? Polynesia.

Obs. The specimen from which the above description has been taken now belongs to the British Museum, and was found, without any label or indication of its locality, among the late Dr. Bowerbank's collections. Whether by the waves originally, or subsequently from other causes, it has been lamentably treated; for at the present time, as above stated, out of the thirty short branches which it once possessed, not one now remains entire, the whole having been broken off at variable distances respectively from their origin in the laminiform portion, and some close to it; while the only branched one which is left projects laterally from that part of the polypary which once *entirely* covered the apex of the shell as well as all other parts, but which is now broken away at this part, on the opposite side, so as to expose the apex of the shell itself, the only part consequently now uncovered (fig. 1, *c*).

At first sight the specimen looks like a shell with branched spines; but on closer inspection this is found to be a mistake, although the branches in some parts may have been initiated

by the presence of short spines on the shell itself. At the same time, as with the lip so with the branches, the whole spine may have been replaced by the polypary of the *Hydractinia*; yet then the shell could not have been either of those mentioned, especially as the largest and greater number of branches are to be found at the extremities; but I shall hereafter show that such branches may arise independently of the presence of any spine at all on the shell over which a *Hydractinia* may have grown. The large branches are so like in form, structure, and colour, together with their spines, to the branches of *Dehitella atrorubens* that no doubt can be entertained of the latter being identical with the former, except in specification; while the grooved, anastomosing venation on the surface, which does not exist on *D. atrorubens* and the other bush-like forms that I have examined, is equally identical with that of the fossil species *Hydractinia pliocena* ('Annals,' 1877, vol. xix. pl. viii. fig. 8), which is also present, but less markedly seen, in *H. echinata*.

This grooved venation (fig. 4), which is the bed of the cœnosarcal tubulation in which the whole organism originates from the commencement, and is the same in structure and function where it forms the first sarcodic lamina on the shell ('Annals,' 1877, *l. c.* p. 46) as on the surface of the full-grown polypary, is more or less repeated as a proliferous membrane on the surface of every layer, although it may not be so marked in some as in other species; yet, in the present instance, it is as striking in the chitinous polypary of the recent *H. arborescens* as it is in the assumed calcareous one of the fossil species *Hydractinia pliocena*, and will be found even more developed in the new fossil species I am about to describe.

Previously, however, it is desirable that I should add a few words on the recent species.

Hydractinia calcarea, Cart.

Since the description of this was published ('Annals,' 1877, vol. xix. p. 50), Mr. Thomas Higgin, of Liverpool, has kindly sent me some more specimens on equally small shells of *Fusus* and *Nerita* respectively, from the same locality, many of which possess short branches which, in two instances, growing from a specimen on the smooth surface of a *Nerita*, at once point out that *they*, at all events, do not originate in the presence of a spine on the shell which may have become covered or entirely replaced by the polypary of the *Hydractinia*, as at first supposed ('Annals,' 1877, *l. c.* p. 51), but are distinct branches or processes similar to those of the

chitinous species just described. On the smooth species of *Nerita*, to which I have alluded, the development of the branch can be followed throughout from the spine of the polypary to its ultimate form, which in the largest specimens is about 1-10th inch in diameter and 1-4th of an inch long, with a tendency to assume a compressed, palmate, bifurcate shape at the free extremity. So it should be remembered that the calcareous polypary of *Hydractinia calcarea* may also be branched like the chitinous one of *H. arborescens*.

Hydractinia Kingii, n. sp.

Fossil. Polypary massive, growing over a turreted shell, somewhat like that supporting *Hydractinia arborescens*, compressed, extending here and there irregularly into a short, thick lobe, process, or branch. Composed of compact, greyish-white limestone. Surface uniformly even, thickly veined with anastomosing grooves amongst granular ridges once surrounding the holes of the polypites, which are now filled up and undistinguishable from the rest of the calcareous material; pustuliferous—that is, presenting numerous depressed papillary elevations, which are the representatives of the spines in other species, and where broken open (as many are) disclosing the grooved venation on the surface of the subjacent layer. Internal structure concentrically laminated, presenting in a vertical section rows of chambers (? the hollow bases of the pustules of each layer), between which are the vertical tubes of the polypites, now, for the most part, filled with calcareous matter, but, where still hollow, possessing a diameter of 3-1800ths inch, and at their openings into the roofs of the chambers respectively a calcareous diaphragm with central hole, similar in form to that of *Hydractinia calcarea* ('Annals,' 1877, vol. xix. p. 51, pl. viii. fig. 4, *g g*), but apparently without its repetition which is seen along the vertical tubes in *Hydractinia pliocena*—a point, however, that must be decided by a more favourable specimen than the one which I possess. Size of the fragment from which the above description is taken about an inch square and half an inch thick. Thickest portion of the polypary from the shell outwards 5-12ths inch; largest lobo-branch, which is circular in the section, but whose extremity has been broken off, $\frac{1}{4}$ inch in diameter, and the same in length.

Hab. Marine, on a turreted shell like *Phos senticosus*; or it may have been a *Cerithium*, as there is only a fragment of the apex left in the specimen for this determination.

Loc. ? Subapennine strata.

Obs. At first I thought this was a specimen of *Hydractinia*

pliocena; but subsequent and more particular examination shows that it has several specific differences, viz. :—1, the visible venation is much denser in *H. Kingii* than in *H. pliocena*; 2, there are no spines on the former, which, as before stated, are represented by pustuliform elevations; 3, the entire mass is irregular in form and extended into a thick lobo-branch or process here and there; 4, the vertical tubes present no diaphragm or septal divisions, except the one above mentioned. It has been named after Prof. King, of Galway, who kindly sent me the specimen, which he thought came from the Subapennines and had already received a name.

Millepora alcicornis.

As this is a well-known species, having been named by Linnæus, stated by Ellis and Solander to be so abundant in the West Indies as to be "used principally for burning into lime," and pronounced by Agassiz, in 1859, to be "very nearly related to the Hydractiniæ," I shall only describe so much of it (from a dried fragment which, by accident, has lately fallen into my hands with fragments of sponges which indicate that it came from the seas between the two Americas) as may be necessary for the purpose of showing how closely allied in structure its corallum or polypary is to that of *Stromatopora*.

Its specific designation well indicates the general form. The surface is harsh to the touch from being composed of the pointed free ends of a meandering reticulation of anastomosing more or less flat fibre, whose interstices form the openings of a subjacent structure, which will be more particularly described hereafter, rendered uniformly uneven or bossed by gentle elevations and depressions; over which, scattered more or less irregularly, are many apertures that may be divided into two sets, viz. large and small, the latter most numerous; the largest, which more especially have a toothed or subasteroid margin, are about 1-120th inch in diameter and 1-12th inch. apart, while the smaller ones are about 1-225th inch in diameter and 1-48th inch apart; but both vary slightly in size and in their distances from each other. Besides this, the surface presents here and there an intricate tubular venation composed of chitinous canals in relief, more or less covered with calcareous material, whose minute branches anastomose freely over the points of the meandering reticulation mentioned, and, in many instances, become lost beneath it, the largest branches averaging 1-360th inch in diameter. I note this particularly because we shall find remnants of it by-and-by (fig. 8, *a*) on the surface of the fossil called

Millepora Woodwardii). *Internal structure* :—The surface, as already intimated, is the outward limit of a subjacent cancellated structure (fig. 5, *b b*), formed by the anastomosis of more or less flattened reticulated fibre; and this, which is the staple substance of the corallum, is remarkable for its minuteness and the tortuous form of both its solid and cavernous parts, the latter in the fresh state being occupied by the cœnosarc, which is thus brought into direct continuation with the exterior. After forming a layer of about 1-180th inch in thickness and of yellowish-white colour, it becomes more compact and presents a bluish tint, which thus establishes a distinct line of demarcation between the two; while, when the superficial layer is carefully picked off with a sharp point, the horizontal surface of the subjacent one is seen to be traversed by a deep grooved venation similar to that of *Hydractinia arborescens*, &c., with here and there the remains of a dry sarcodic cœnosarcal tube in it running along its course, thus indicating that the surface-layer, which is less compact, of a different colour, and overrun here and there by a tubular venation, is the external layer of the growing corallum; and therefore we may fairly infer that successively the corallum has been formed in this way throughout, although somewhat modified in density &c. by age and subsequent development.

Having now described the staple substance of the corallum from the surface to the axis of the branch (that is, from the circumference to the centre), we have next to follow the large apertures in the same way. These, in the vertical section, may be observed to be the openings of tubular spaces varying from 1-360th to 1-180th inch in diameter, which descend more or less vertically and nearly to the central plane that separates the two laminæ of which the elkhorn-like compressed branch is formed (fig. 5, *a a*). Further, it may be observed that these spaces are horizontally but unequally divided into several compartments by very thin transverse septa or *tabulæ* (fig. 5, *c*), and that their internal surface is plentifully perforated by more or less rounded apertures (fig. 5, *e*) such as may be seen in *Stromatopora*, which communicate with the tortuous cavities of the cœnosarcal skeleton or cancellated structure of the corallum, so that the tubular spaces are as much foraminated (fig. 5, *c*, *d*) as the cœnosarcal skeleton is cancellated, being simply excavated in the midst of the latter, without the least trace of any distinct parietes after the cœnosarc has been abstracted. Indeed it is very remarkable that all the cavities of the cœnosarcal skeleton (that is, of the whole corallum, like that of *Parkeria* &c.) are formed upon the cœnosarc (identical in this respect with the can-

cellous structure of bone), so that, in the absence of the latter, as just stated, none of them presents the least sign of a wall. The only part which appears solid or different from the rest in structure is the *tabula* or transverse septum of the tubular excavations (fig. 5, *c*). Indeed, here as elsewhere in the Hydractiniidæ, it is the intricate anastomosis of the minute branches of the cœnosarc which leads to the formation of the peculiar, cancellated, cœnosarcal skeleton, which, again, is as indicative of the structure of the Hydractiniidæ as it is opposed to that of the Foraminifera. Not unfrequently the *tabula* is surmounted centrally by a kind of style, which, in some species of *Stromatopora*, seems to be indicated by the presence of a white point in the centre of the transparent calc-spar filling the rest of the calicle.

Finally, if the elkhorn-like branch of *Millepora alcicornis* be split in two through the centre parallel with its flat surface, the plane of each part thus exposed will present concentric lines of lamination in the cancellous structure, which, extending from side to side parallel with the plane, indicate the progressive formation of the flat branch upwards from the point at which it commenced to expand. These lines of lamination, however, are, in accordance with the rest of the structure, not indicated by distinct laminæ, but by the position of the rows of apertures in the cœnosarcal skeleton or corallum.

Thus we have every thing structural in the corallum of *Millepora alcicornis* that is to be found in *Stromatopora*, excepting the *stelliform* systems of venation.

What, then, were those "stelliform systems" which, in my paper on *Hydractinia*, &c. ('Annals,' 1877, vol. xix. p. 68, and pl. viii. figs. 19 &c.), I have likened to the superficial stelliform excretory canal-systems of some sponges, and suggested a like function? I need hardly answer the question, after what has been above stated, especially when they are to be seen on the upper surface of every layer of a *Stromatopora* as it is split off from the entire specimen. They were not water-vascular excretory systems as in sponges, but tubular venations of the cœnosarc on the surface, probably filled with "entodermic cells," as will appear hereafter, preparing the way proliferously for the new layer; and, although in no instance that I know of, yet there may be an existing species of *Millepora* in which the grooved venation, instead of meandering generally over the surface in large branches and sending off smaller ones, which by subdivision become still smaller, and ultimately intermingle with each other (like the capil-

lary system of blood-vessels in the warm-blooded animals), proceeds from central points, and thus resembles the stelliform arrangement characteristic of *Stromatopora*.

That this stelliform arrangement should not have been exactly the same even in the different species of *Stromatopora* is as certain as that in all it seems to have been connected with the same function, and that function to have been what has been above stated. But let us now turn for a few moments to the able observations of Mr. H. Moseley, who has studied the Milleporidæ in their living state (Phil. Trans. 1876, vol. 166, p. 91).

Mr. Moseley states that specimens of *Heliopora cærulea*, which were obtained at Zamboangan, in Mindanao, one of the Philippine Islands, and *Millepora alcicornis*, in "great profusion" at Bermuda, were found to be as different in their minute structure as in their general form; for while the corallum of *Heliopora cærulea* was observed to consist of "tubes of circular section, of nearly uniform diameter, closely packed side by side . . . . with their walls, where touching, fused together," and the intervals filled up by a hard tissue, which appears above the margins of the tubes "in papilliform prominences" (*l. c.* p. 99), that of *Millepora alcicornis* was found to be composed of a network of tortuous branches of hard tissue, in which "the soft tissues appear to occupy a series of tortuous canals," "that lead from the calicles in all directions, and, anastomosing freely with one another, join the cavities of the surrounding calicles" (*l. c.* p. 113)—to which, as before stated, might be added that the tubes of the calicles are imbedded in this tissue at variable distances from each other respectively, as further indicated by the distance between these apertures on the surface.

Moreover Mr. Moseley describes our "grooved venation" as "canal-systems," the tubes of which are "not only lined by, but also always more or less filled with entodermic cells." They are divided into two systems, viz. a deep or horizontal and a superficial or more or less vertical system—the former being that which I have more particularly described in *Millepora alcicornis*, and whose canals, cut across in the vertical section of this species, may be seen just below the last-formed or external layer in the same position as that figured by Mr. Moseley in *Heliopora* (*l. c.* p. 105, pl. viii. fig. 1, V′, and pl. ix. fig. 8). That this is not a water-vascular system is thus proved beyond a doubt, as clearly as that it is the grooved venation, in which the original soft tube may be seen, as first noticed in *Hydractinia echinata* ('Annals,' 1877, vol. xix.

p. 48, pl. viii. fig. 3), and now in a dried state subsequently in the venation on the penultimate layer of *Millepora alcicornis*.

But these views are opposed to those of Drs. Nicholson and Murie, in the report of whose paper on the minute "structure of *Stromatopora*," read before the Linnean Society on the 20th Dec. last, we read that the authors "discard the notion of its alliance [that of *Stromatopora*] with the Nullipores, or belonging to the corals, Hydrozoa, or Foraminifera;" while, "under negative evidence," they would constitute for the Stromatoporids "a new order of calcareous sponges—Stromatoporidea." Herein, I need hardly state, it is impossible for me to acquiesce.

Millepora Woodwardii, cast. (Pl. XVII. figs. 6–9.)

Lastly I must advert to the fossil from the "Lower Chalk" of Dover, kindly sent to me by Mr. Woodward of the British Museum, last year, and described in the 'Annals' (vol. xix. p. 64) under the provisional name of "*Bradya tergestina*," Stache, MS."—chiefly for the purpose of giving a figure of it, which I then had not the opportunity of doing, as my plate of illustrations had been filled up previous to its arrival.

Having in my private journal, however, accurately sketched the upper portion of it, together with the section, of the *natural size*, it is herewith reproduced (figs. 6, 7), as well as a magnified view of the fragments of the "creeping, branched, tortuous, dendriform fibre in prominent relief," mentioned at p. 65 (*l. c.*), that remains on its surface (fig. 8, *a*), and a diagram, to scale, of one of the tubular spaces (fig. 9, *a*), now observed to be septate like that of *Millepora alcicornis*. To the great resemblance of the stelliform systems of venation (fig. 6, *aa*) to, if not identity with, those of *Stromatopora* I have already alluded; I have also likened them to the "creeping, branched, tortuous, dendriform fibre in relief" on the surface of the chitinous one, *Hydractinia echinata*; and now they may be identified with the calcareous one on the surface of *Millepora alcicornis*. I have also since seen the base of this fossil, which presents no stelliform venation, but an irregular surface indicative of that of attachment, while the upper or sectionized polished part shows that the tubes had septa (*tabulæ*) like those of *Stromatopora* and *Millepora alcicornis*; lastly, I observe towards the periphery a great number of minute spherical bodies of different sizes below the 3-1800ths inch in diameter, which appear to have been ova.

Can D'Orbigny's *Stellispongia variabilis*, which extends from the Trias to the Upper Chalk (Senonien—not "Sues-

sonien" or Eocene as stated by mistake in my paper, 'Annals,' *l. c.* p. 67), be allied to *Millepora Woodwardii*? At all events the former brings down the stelliform systems of venation seen in the Silurian *Stromatopora* &c. to the Chalk age, as indicated by the type specimen from the Trias, given by D'Orbigny (Cours élément. Paléont. et Géologie, vol. ii. p. 411, fig. 407), of which a tracing will be found among the illustrations (fig. 10).

Through the kindness of Mr. Woodward I have also been able to examine the little globular fossils generally, in the British Museum, which have been obtained from the chalk of Dover, when being washed and prepared for officinal purposes. These would appear to have been first called by Phillips *Millepora globularis* ('Geology of Yorkshire,' 1829, vol. i. p. 234, tab. 1. fig. 12), and are identical in structure with *Millepora Woodwardii*, except that they have no stellate venation or branched tubulation in relief on the surface. Moreover they are frequently more or less perforated by a cylindrical cavity filled with chalk, in which they are identical with some specimens of *Parkeria*, wherein the cavity appears, from its heterogeneous contents, to have been filled with "sea-bottom" (p. 59, *l. c.*); while, from the radiated structure in both *Millepora globularis* and *Parkeria* not having been altered or turned out of its course by the presence of the cavity, it would appear that the latter had been made by some organism after the *Millepora* or *Parkeria* had completed their growth respectively. At the same time, in *Parkeria*, a nucleus of this heterogeneous material frequently appears, singly or in plurality, in the midst of the structure, while some specimens of *Millepora globularis* present two or more such cavities of different depths, indicating that, if the excavating organism perished or left its cavity when the latter was shallow, and the Millepore or *Parkeria* continued to grow afterwards, the cavity might appear in the midst of the structure filled, as we see it in *Parkeria*, with "sea-bottom." Sometimes the excavation passes directly through both *Millepora globularis* and *Parkeria*, simulating, as Mr. Woodward states, the beads of a "prehistoric race;" and sometimes, as just stated, there may be more than one excavation present.

Frequently *Millepora globularis*, when fixed, assumed a hemispherical shape; and also, having frequently grown as if on a conical body, the base presents a corresponding excavation, which is annulated concentrically with alternate grooves and elevations, covered with a smooth compact material, which contrasts strongly with the rough apertured surface of the hemispherical or free side, arising from the projection of

the free ends of the fibre forming cœnosarcal cancellated structure between the apertures of the tubular spaces (? *Lunulites urceolata*, Phillips, *l. c.*, fig. 11). This form also occurs with a conical upper surface, when it somewhat resembles that species of Foraminifera called *Orbitolina lenticularis*, but differs from it in the concentric annulation of the exterior being on the convex instead of on the concave side, to say nothing of the internal structure, as may be seen by my elucidation of this fossil ('Annals,' 1861, vol. viii. pl. xvii. figs. 5–9).

Lastly, there is another subglobular free form, with one or more conical elevations on its upper surface, from which grooves radiate downwards, and, branching as they descend over the globular part of the fossil to its base, become shallower, and finally disappear before reaching the centre. This appears to be only a *free* form of *Millepora Woodwardii*.

In all these fossils we may observe that the remarkable form of cancellated structure which I have described in *Millepora alcicornis*, is excavated by tubular spaces that radiate from the centre to the circumference, where the same structure projects in little points above the surface around their apertures, identically as the horny structure of the same kind projects above the apertures of the polypites in the polypary of *Hydractinia echinata*. This structure is the same in all the branched species of *Hydractinia*, whether living or fossil, chitinous or calcareous; and it is perhaps nowhere seen more beautifully than in the branched *Chitina ericopsis*, where there is no cuticle and no core to the stems, which thus entirely and exclusively consist of this peculiar cancellated tissue excavated by tubular spaces. Such cancellated structure is never seen in any of the Foraminifera, not even in *Polytrema*, and only in a few stony corals; so that its presence, as before stated, appears to be decisive against the *Hydractiniæ* being Foraminifera.

Having, on the 1st January last, received, with three other species of fossils allied to *Hydractinia*, from Dr. Steinmann of Munich, two specimens of *Millepora globularis* (*Porosphæra*, Steinmann) from the Upper Chalk of Hanover, which he very properly identifies with *Bradya tergestina*, the old generic name of Phillips must take precedence of the latter; and therefore I have called the Dover fossil "*Millepora Woodwardii*;" nor will it appear strange after this that Phillips should have applied the name of "*Millepora*" to these little fossils (*l. c.*), subsequently changed by Etheridge to *Coscinopora* (ed. 1875).

When, too, we remember that *Millepora alcicornis* is found under a "variety of forms," one of which is stated by Ellis

and Solander (p. 142) to be "like so many beads of a necklace," and that the structure is radiated, we probably should find these "beads" not only very much like *Millepora globularis*, but, in their hemispherical condition, diminutive forms of *Stromatopora*, saving the stellate arrangement of the cœnosarcal venation.

Millepora globularis and *M. Woodwardii* appear to be closely allied in structure; but as yet I have only been able to see the septa (tabulæ) in the tubular spaces of the latter, and this in only one instance (fig. 9); so it is either uncommon or difficult to recognize.

There is yet another form in the British Museum, about the same size as *Millepora Woodwardii*, which was free. It was irregularly elliptical (having been now cut in two), compressed, and seems to have been globular at first, subsequently overlapped by an additional growth, which causes one side to appear under the form of four triangular segments, crucially arranged, with their points in the centre, two of the segments opposite, being the overlapping parts of the last growth. But the structure otherwise is the same as that of all the rest, viz. radiating tubular spaces, increased in number by branching towards the circumference, where their apertures, therefore, are of unequal size and at slightly variable distances apart, situated in the midst of the peculiar cœnosarcal skeletal tissue above described. The specimen also presents four or more cylindrical excavations on its surface of different depths, one of which reaches nearly to the centre of the fossil.

Thus the forms of this organism may be still more numerous, and, after all, like those of *Millepora alcicornis*, only various growths of the same structure; hence the necessity of a review of all the species of D'Orbigny's *Coscinoporæ* and the like, with which they seem to have been more or less identified, that they may be respectively relegated to their proper position in the animal kingdom.

Postscript, Feb. 7, 1878.

Since the above was written I have received from Dr. Steinmann (on the 4th inst.) a copy of his interesting paper, entitled "Ueber fossile Hydrozoen," published in the 'Palæontographica,' n. F. v. 3 (xxv.), p. 101, in which are enumerated all the species allied to *Hydractinia*, both living and fossil, that have been identified, adding to the latter three new ones, viz. *Sphæractinia diceratina*, *Ellipsactinia ellipsoidea*, and *Cylindrohyphasma Milaschewitschi*, besides changing the generic names of *Millepora globularis*, Phillips,

to *Porosphæra*, and *Ceriopora crispa* et *favosa*, Goldfuss, to *Thalimina* respectively.

It is worthy of notice that the specimen of *Cylindrohyphasma Milaschewitschi*, which consists of a cylindrical portion 2 inches long and 9-24ths inch thick, should have its cavity filled with sea-bottom—that is, a heterogeneous mixture of sand and minute Foraminifera &c., like that which I have stated to occur in *Parkeria*. How does this material, viz. sea-bottom, get there? In a specimen from the "Chalk Marl" just received from Mr. Charles Moore, F.G.S., there is the same condition, viz. the growth of a Hydrozoic (? calcareous) polypary or corallum, somewhat like that of *Parkeria*, round a nucleus of "sea-bottom"—that is, quartz-sand and minute Foraminifera &c. Certainly it was the habit of these Hydrozoa, as it was that of *Stromatopora*, preceded by their soft, sarcodic, proliferous membrane, to run in between and over every thing with which they came into contact. I possess a block of *Stromatopora* from the Devonian Limestone in the neighbourhood of Ipplepen (near Torbay) and its environs, in which this is represented upon a large scale, there being fragments of half a dozen other things besides shells &c. in a mass of *Stromatopora* which must have originally been two or three feet at least in diameter. It was given to me by my friend Mr. William Vicary, of Exeter, who has perhaps as fine a collection of *Stromatopora* as any in existence.

In his concluding remarks Dr. Steinmann places *Stromatopora* under *Sphæractinia*; *Loftusia* under *Ellipsactinia*; and *Parkeria* with *Porosphæra*.

Porosphæra is adopted, as before stated, for Phillips's *Millepora*, generically; and unquestionably the use of *Millepora* here is confusing; at the same time it shows how sensible Phillips was of the real nature of this fossil originally.

Dr. Steinmann's paper is beautifully illustrated, and an advance upon the subject which cannot be ignored by those who wish to keep pace with palæontological knowledge. The slight discrepancy that exists between my figure of *Hydractinia arborescens* and that given by Dr. Steinmann arises from the latter having been lithographed from a rough sketch and the former from a finished drawing.

As regards the Stromatoporoid origin of *Eozoon*, however (footnote, p. 114), of which a type specimen is now before me, it might be observed that "moss-agates" from the trap of Western India frequently present arborescent *glauconite* as much like organic remains as the so-called *Eozoon* is remote from such resemblance. When, therefore, the figure in the metamorphic rock is even as like organic remains as that in

the Plutonic one, it will be quite time to speculate as to its original nature; till then it must remain in the abode of *omne ignotum pro magnifico*, into which science forbids her votary to enter. (The specimen of *Eozoon* to which I have alluded (a slice about $2\frac{1}{2} \times 2$ inches), was sent by Dr. Carpenter to Profs. King and Rowney, of the Galway College, Ireland, who kindly presented it to me.)

EXPLANATION OF PLATE XVII.

Fig. 1. *Hydractinia arborescens*, n. sp., on a turreted shell. Natural size. Branches of the specimen broken off. *a a*, branches; *b*, largest branch; *c*, apex of the shell exposed, from a portion of the polypary having been broken off; *d*, lip of shell transformed into polypary, also broken.

Fig. 2. The same. Diagram of portion of surface of the polypary, to show:—*a a*, large branch of the grooved venation passing through the surface; *b b*, apertures of the polypites, &c.; *c c*, lines indicating the position of the grano-serrulated ridges of the polypary. Scale about 1-96th to 1-1800th inch.

Fig. 3. The same. Diagram of portion of surface of polypary, more magnified, to show:—*a a*, apertures of polypites &c. in relation to *b b*, grano-serrulated ridges. Scale about 1-48th to 1-1800th inch.

Fig. 4. The same. Diagram of portion of surface of polypary, to show the grooved venation *only*. Magnified about 2 diameters.

Fig. 5. *Millepora alcicornis*. Diagram of portion of corallum including vertical section of part of a tubular space. Much magnified. *a a*, tubular space; *b b*, cœnosarcal skeleton; *c*, transverse septa or *tabulæ*; *d*, apertures of the cancelli in the cœnosarcal skeleton; *e*, the same, opening into the tubular space. Transverse diameter of tubular space about 1-120th inch.

Fig. 6. *Millepora Woodwardii*. Surface of upper half. Natural size. *a a*, systems of stelliform venation. [N.B. For the description of this fossil see 'Annals,' 1877, vol. xix. p. 64, under the provisional name of "*Bradya tergestina*, Stache, MS."]

Fig. 7. The same. Horizontal section. Natural size. *a*, horizontal section of tubular spaces at the centre; *b*, oblique section of the tubular spaces at the circumference.

Fig. 8. The same. Diagram of a portion of the surface, much magnified, to show the fossilized fragments of a superficial tubulation like that appearing above the outer layer on some parts of *Millepora alcicornis*. *a*, branches of tubulation; *b*, subjacent apertures of calicles or tubular spaces. Scale about 1-48th to 6-1800ths inch.

Fig. 9. The same. Diagram of portion of the corallum, including a vertical section of part of a tubular space bearing septa or *tabulæ*. More magnified. *a a a*, radiating tubular spaces; *b b*, cœnosarcal skeleton between the radiating tubular spaces; *c*, transverse septa or *tabulæ*; *d*, apertures of the cœnosarcal skeleton in the tubular space; *e*, surface of corallum.

Fig. 10. *Stellispongia variabilis*, D'Orb., from the Trias. Traced from his figure (Cours élément. de Paléontol. et Géologie, vol. i. p. 214, fig. 338). *a a*, systems of stelliform venation; *b*, portion of surface, more magnified.